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(54) PRODUCTION OF DISPERSION STRENGTHENED METALLIC COMPOSITE MATERIAL

(57)Abstract:
PURPOSE: To easily produce the dispersion strengthened metallic composite material having good quality by dividing the target component compsn. of an alloy for dispersion medium by the temp. width between a solidus line-liquidus line, adding and mixing a dispersion strengthening material to and with a slurry of the broader component compsn. and incorporating the slurry into the molten metal under stirring of the remaining component compsn.
CONSTITUTION: The component compsn. (for example, Cu-1mass% Sn alloy) of the broader temp. width between the solidus line-liquidus line than the target component compsn. of the dispersion medium is prepd. as the slurry of the liquid-solid mixed phases. While this slurry is kept stirred, the dispersion strengthening material (for example, Al2O3 particles) is added and mixed to and with the slurry to form the precomposite material. The precomposite material is incorporated into the molten metal (for example, pure copper) prepd. to the remaining component compsn. under stirring to uniformly disperse the dispersion strengthening material, by which the composite material (for example, consisting of Cu-0.19mass% Sn alloy and the Al2O3 particles) is prepd. As a result, the dispersion strengthened metallic composite material (for example, high-strength conductive material) having the good quality is obtd.

CLAIMS

[Claim(s)]
[Claim 1]A target component presentation of an alloy made into carrier fluid of dispersion-strengthening type metal group composite is divided into component composition which compares with temperature width between the solidus-line-liquidus line, and serves as wider temperature width, and the remaining component composition, A manufacturing method of dispersion-strengthening type metal group composite mixing this ******** to a stirring molten metal which the above-mentioned temperature width added and mixed dispersion-strengthening material into liquid-solid mixed phase slurry adjusted to larger component composition, and was adjusted to ********, nothing, and the remaining above-mentioned component composition, and preparing to a target component presentation.
[Claim 2]A manufacturing method of dispersion-strengthening type metal group composite being a super-low alloy which a stirring molten metal uses as a pure metal or a this group in claim 1.
[Claim 3]A manufacturing method of dispersion-strengthening type metal group composite whose dispersion-strengthening material is ceramics particles, whose stirring molten metal is pure copper or a thin copper alloy in claim 1 and whose dispersion-strengthening type metal group composite obtained is a high intensity quantity electrical conducting material.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention proposes the suitable manufacturing method of the dispersion-strengthening type metal group composite (only henceforth composite) which dispersion-strengthening material, such as metal, metallic compounds, ceramics particles, or a whisker, distributes uniformly in metal carrier fluid (matrix).
[0002]In recent years, the composite which can aim at improvement in the quality characteristics, such as intensity of a member, attracts attention, and utilization is advanced. In order to acquire cheap remarkably good quality as having suited manufacture of this composite, it becomes important how dispersion-strengthening material is uniformly distributed in carrier fluid.
[0003]
[Description of the Prior Art]As a manufacturing method of composite, a high pressure casting process, powder-metallurgy processing, the mechanical alloying method, an internal oxidation method, the molten metal stirring method, the half-coagulation stirring method, etc. which are described below, respectively are known until now.
[0004]High pressure casting process: Make preforming of dispersion-strengthening material and carry out application-of-pressure impregnating coagulation of the molten metal made into carrier fluid at this.
Powder-metallurgy processing: Carry out disintegration of the alloy made into carrier fluid, mix this after alloy powder and dispersion-strengthening material, and join after alloy powder by application of pressure, extrusion, etc.
The mechanical-alloying method: Carry out disintegration of the alloy made into carrier fluid, mix this after alloy powder and dispersion-strengthening material, and knead together mechanically.
Internal-oxidation method: Carry out internal oxidation of the specific ingredient made to contain in the alloy made into carrier fluid.
The molten-metal stirring method: Add and stir dispersion-strengthening material and mix in the molten metal made into carrier fluid.
The half-coagulation stirring method (also in half-melting, it contains): Change into a liquid-solid mixed phase state the alloy made into carrier fluid, add and stir dispersion-strengthening material and mix in this.
[0005]In the high pressure casting process which makes preforming of dispersion-strengthening material among these manufacturing methods, powder-metallurgy processing which uses after alloy powder and the mechanical alloying method, and also an internal oxidation method, many [intricately] the manufacturing process is not preferred. It is difficult to manufacture large-sized composite in these manufacturing methods.
[0006]On the other hand, by the molten metal stirring method or the half-coagulation stirring method, it has the advantage that a process tends to build simple and composite large-sized few moreover. However, by the molten metal stirring method, it is difficult to carry out mixing distribution of the dispersion-strengthening material uniformly, i.e., obtain good composite-ization, and becomes the composite which was inferior in quality. Although good composite-ization is obtained in the half-coagulation stirring method, since it is important to maintain the alloy made into carrier fluid in this method in the good liquid-solid mixed phase state, it has a problem in each with the alloy with narrow temperature width between the solidus-line-liquidus lines -- manufacture of composite becomes difficult.
[0007]
[Problem(s) to be Solved by the Invention]This invention aims to let the good composite of quality propose the cheap manufacturing method obtained easily, even if there is no temperature width between the solidus-line-

liquidus lines of the alloy made into carrier fluid of the composite which it is going to manufacture even if in view of the above-mentioned situation.
[0008]
[Means for Solving the Problem]A gist of this invention a target component presentation of an alloy made into carrier fluid of dispersion-strengthening type metal group composite, It divides into component composition which compares with temperature width between the solidus-line-liquidus line, and serves as wider temperature width, and the remaining component composition, The above-mentioned temperature width is a manufacturing method of dispersion-strengthening type metal group composite mixing this ******** to a stirring molten metal which added and mixed dispersion-strengthening material into liquid-solid mixed phase slurry adjusted to larger component composition, and was adjusted to ********, nothing, and the remaining above-mentioned component composition, and preparing to a target component presentation, [0009]In the above, a stirring molten metal is a pure metal or a super-low alloy based on this, further, dispersion-strengthening material is ceramics particles, a stirring molten metal is pure copper or a thin copper alloy, and composite obtained is a high intensity quantity electrical conducting material.
[0010]
[Function]An operation of this invention is described below in more detail. Although it is very easy to build a molten metal with the molten metal stirring method, since the viscosity is low, making dispersion-strengthening material mixing uniformly and what is called good composite-ization are not obtained. On the other hand, by the half-coagulation stirring method, although it is suitable for mixing of dispersion-strengthening material, if the temperature width between the solidus-line-liquidus lines of the alloy made into carrier fluid is narrow, it will be difficult to be stabilized and to maintain a good liquid-solid mixed phase state also including the time of addition of dispersion-strengthening material, and good composite-ization will no longer be obtained.
[0011]Therefore, the thing for which ******** which mixed dispersion-strengthening material in consideration of the above-mentioned characteristic into the liquid-solid mixed phase slurry of the component composition which a liquid-solid mixed phase state is stabilized and can be maintained, and distributed dispersion-strengthening material uniformly beforehand is built with this invention, Then, the composite prepared by the target component presentation of the alloy made into carrier fluid of composite as a result is manufactured by mixing this ******** to a stirring molten metal.
[0012]The above is described below still more concretely. The target component presentation of an alloy made into carrier fluid of the composite which it is going to manufacture is divided into the two component composition A and B. That is, A chooses the component composition whose temperature width between the solidus-line-liquidus lines is wider than a target component presentation, and it is made for B to become a target component presentation by alloying A and B as remaining component composition.
[0013]As for the temperature width between the solidus-line-liquidus lines of the component composition A, it is preferred here to consider it as not less than 30 **.
[0014]And ******** which mixed dispersion-strengthening material in the liquid-solid mixed phase slurry adjusted to the component composition A, and was composite-ized beforehand is built, and when the above-mentioned ******** is made to mix to the stirring molten metal adjusted to the component composition B and A and B alloy, the alloy made into carrier fluid serves as composite prepared by the target component presentation.
[0015]Once inserting in with slurry form and making it massive on the occasion of mixing to the stirring molten metal of the above-mentioned ********, it is also good to insert this in. However, it is preferred to use what was cut to the wafer so that the medium may dissolve easily, in inserting in, after making it massive.
[0016]Thus, since component composition of the liquid-solid mixed phase slurry which adds and mixes dispersion-strengthening material is made into the component composition A whose temperature width between the solidus-line-liquidus lines is wider than the target component presentation of an alloy made into carrier fluid of composite, It is stabilized and a good liquid-solid mixed phase state can be made easily, and since dispersion-strengthening material is added and mixed into the slurry of this good liquid-solid mixed phase state, good ******** of a compound state is obtained.
[0017]Subsequently, since this ******** is inserted in to the stirring molten metal of the component composition B, the medium of ******** dissolves, and the composite which A and B became what was prepared by the target component presentation of the alloy made into carrier fluid of the composite obtained by alloying easily, and distributed uniformly [dispersion-strengthening material] in carrier fluid is obtained.
[0018]In the above, in order to achieve the uniform dispersion of the dispersion-strengthening material currently

distributed in ********, and perfect alloying with A and B, it is important to continue stirring of a molten metal, until it inserts ******** in a stirring molten metal and makes it dissolve in it thoroughly.
[0019]When the target component presentation of carrier fluid is a low alloy like the copper alloy in which high conductivity is demanded, in order to make component composition A into the component composition which is easy to build liquid-solid mixed phase slurry, the component composition B serves as a pure metal or a super-low alloy near this. However, it is not this limitation if carrier fluid is one of the things of a high alloy, or an eutectic alloy presentation or the component composition near this.
[0020]Although it is applicable in favor of aluminum system alloy, Cu system alloy, and other alloy systems, since this invention maintains especially high conductivity and can measure improving strength, it is used for manufacture of the high intensity electrical conducting material which used ceramics for dispersion-strengthening material and used pure copper or a thin copper alloy for the stirring molten metal, and is preferred.

[0021]
[Example]First, the composite manufacturing installation used for the example of this invention is explained based on a drawing. Drawing 1 is an explanatory view of a composite manufacturing installation. In this figure, as for the rotator for stirring, and 3, 1 is [an additional ingredient charging apparatus and 5] molds a dispersion-strengthening material addition device and 4 a crucible and 2, these are installed in the space of the airtight structure formed with the vacuum tank 6, and the exhaust port 7 and the controlled atmosphere feed port 8 are established in the vacuum tank 6.
[0022]As an example of conformity of this invention, the above-mentioned composite manufacturing installation is used and the target component presentation of carrier fluid is a Cu-0.19mass% Sn alloy. (solidus-line-liquidus-temperature width: 6 **) Dispersion-strengthening material (aluminum$_2O_3$) manufactured the composite scattered by 1wt% by the following.
[0023]Cu-1mass% Sn alloy selected as component composition whose temperature width between the solidus-line-liquidus lines is wider than the target component presentation of carrier fluid (solidus-line-liquidus-temperature width: 33 **) 2500 g within the crucible 1, Temperature : Considering it as the liquid-solid mixed phase slurry of 1067 ** and solid phase rate:0.3, and adding stirring by the rotator 2 for stirring particle diameter:1micrometer aluminum$_2O_3$ particle from the dispersion-strengthening material addition device 3, To the inside of the above-mentioned liquid-solid mixed phase slurry With the adding speed of 1.0 g/min It crosses in 132 minutes and is the sum total. 132g adds, While continuing stirring by the rotator 2 for stirring after that After carrying out temperature up to 1125 **, the ******** composite ingot (Cu-1mass% Sn alloy: 95wt% and aluminum$_2O_3$ particle:5wt%) was cast to the mold 5, and this ingot was cut in size of 20x20x20 mm.
[0024]Next, it is pure copper. It is in the crucible 2 about 3000 g, and is temperature:1133 ** (liquidus temperature of +50 **). After holding the molten metal which carried out temperature up for 30 minutes, adding stirring by the rotator 2 for stirring, ******** which the above cut to this stirring molten metal Insert in 750 g from the additional ingredient charging apparatus 4, and that medium is dissolved, It was made to alloy with pure copper, and uniform dispersion-ization of dispersion-strengthening material was achieved, and after preparing to the target component presentation of an alloy made into carrier fluid, it ****(ed) to the mold 5 and was considered as the composite ingot (Cu-0.19 mass % Sn alloy: 99wt% and aluminum$_2O_3$ particle:1wt%).
[0025]About the composite ingot obtained in this way, the distributed situation of dispersion-strengthening material, conductivity, hardness, etc. were investigated. Distributing dispersion-strengthening material uniformly as a result, the material of the high intensity high conductivity of hardness:70 (HR_F) was obtained conductivity:75%.
[0026]On the other hand, as a comparative example, Cu-0.19mass% Sn alloy 2400g which is a target component of carrier fluid was tried in order to build liquid-solid mixed phase slurry within the crucible 1, but when lowered near the liquidus temperature (1082 **) in the stirring bath, it was unable for generating of shell to become remarkable and to lower temperature more. Then, the state of a stirring bath is stable. Although it held to the temperature of 1132 ** and addition of particle diameter:1micrometer aluminum$_2O_3$ particle was tried, most aluminum$_2O_3$ particles were not mixed into the bath, floated on a bath surface.
[0027]
[Effect of the Invention]This invention divides the target component presentation of an alloy made into carrier

fluid of composite into the component composition which compares with the temperature width between that solidus-line-liquidus line, and serves as wider temperature width, and the remaining component composition, Add and mix dispersion-strengthening material and it is made with ******** the liquid-solid mixed phase slurry adjusted to the former component composition, Are a manufacturing method of the composite which mixes the above-mentioned ******** to the stirring molten metal adjusted to the latter component composition, and is adjusted to a target component presentation, and according to this invention. The kind of alloy made into carrier fluid applicable compared with the conventional half-solidifying method can be expanded by leaps and bounds, and the good composite of quality can be manufactured cheaply.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is the explanatory view of a composite manufacturing installation used for the example.
[Description of Notations]
1 Crucible
2 The rotator for stirring
3 Dispersion-strengthening material addition device
4 Additional ingredient charging apparatus
5 Mold
6 Vacuum tank
7 Exhaust port
8 Inactive gas feed port

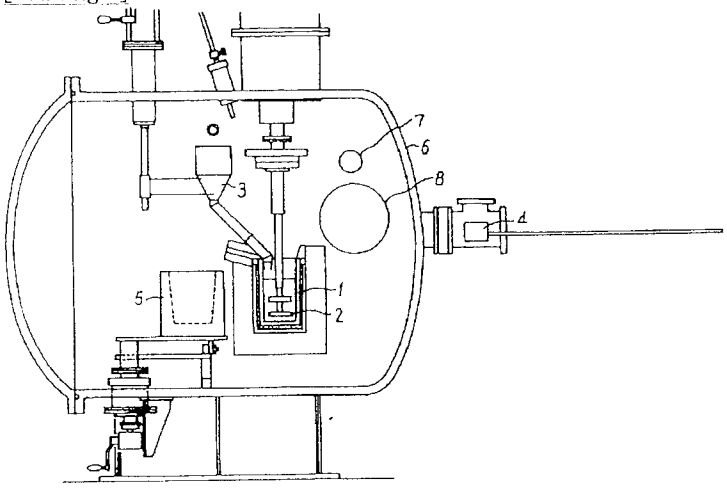
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



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(54)【発明の名称】　分散強化型金属基複合材の製造方法

(57)【要約】

【目的】　複合材の分散媒とする合金の固相線－液相線間の温度幅がたとえないものであっても、品質の良好な分散強化型金属基複合材を安価でかつ容易に製造できるものとする。

【構成】　複合材の分散媒とする合金の目標成分組成を、その固相線－液相線間の温度幅に比しより広い温度幅となる成分組成と残りの成分組成とにわけ、温度幅がより広い成分組成に調整した液固混相スラリ中へ分散強化材を混入して予複合材とし、残りの成分組成に調整した攪拌溶湯に対して上記予複合材を混入して目標合金成分に調製する。

【特許請求の範囲】
【請求項１】　分散強化型金属基複合材の分散媒とする合金の目標成分組成を、その固相線－液相線間の温度幅に比しより広い温度幅となる成分組成と残りの成分組成とにわけ、
上記温度幅がより広い成分組成に調整した液固混相スラリ中へ分散強化材を添加・混入して予複合材となし、
上記残りの成分組成に調整した撹拌溶湯に対し該予複合材を混入して目標成分組成に調製することを特徴とする分散強化型金属基複合材の製造方法。
【請求項２】　請求項１において、撹拌溶湯が純金属ないしはこれ基とする極低合金であることを特徴とする分散強化型金属基複合材の製造方法。
【請求項３】　請求項１において、分散強化材がセラミックス粒子、撹拌溶湯が純銅ないしは希薄銅合金であり、得られる分散強化型金属基複合材が高強度高導電材料である分散強化型金属基複合材の製造方法。

【発明の詳細な説明】
【０００１】
【産業上の利用分野】この発明は、金属、金属化合物又はセラミックス粒子あるいはウィスカー等の分散強化材が金属分散媒（マトリックス）中に均一に分散してなる分散強化型金属基複合材（以下単に複合材という）の好適な製造方法を提案するものである。
【０００２】近年、部材の強度などその品質特性の向上がはかれる複合材が注目され、実用化が進められている。この複合材の製造にあったっては、安価であることのほか、良好な品質を得るために、分散媒中に分散強化材をいかに均一に分散させるかが重要になる。
【０００３】
【従来の技術】これまでに複合材の製造法としては、それぞれ以下に述べる高圧鋳造法、粉末冶金法、メカニカルアロイング法、内部酸化法、溶湯撹拌法及び半凝固撹拌法等が知られている。
【０００４】高圧鋳造法：分散強化材のプリフォームを作り、これに分散媒とする合金溶湯を加圧含浸凝固させる。
粉末冶金法：分散媒とする合金を粉末化し、この合金粉末と分散強化材とを混合し、加圧、押出し等により合金粉末同士を接合させる。
メカニカルアロイング法：分散媒とする合金を粉末化し、この合金粉末と分散強化材とを混合して機械的に練り合せる。
内部酸化法：分散媒とする合金中に含有させた特定の成分を内部酸化させる。
溶湯撹拌法：分散媒とする合金溶湯に分散強化材を添加・撹拌して混入する。
半凝固撹拌法（半溶融の場合も含む）：分散媒とする合金を液固混相状態にし、これに分散強化材を添加・撹拌して混入する。
【０００５】これらの製造法のうち、分散強化材のプリフォームを作る高圧鋳造法や、合金粉末を使用する粉末冶金法及びメカニカルアロイング法、さらには内部酸化法などでは、その製造工程が複雑でかつ多く好ましくない。また、これらの製造法では大型の複合材を製造することは困難である。
【０００６】一方、溶湯撹拌法や半凝固撹拌法では工程が単純でかつ少なく、しかも大型の複合材を造り易いという利点を有している。しかしながら、溶湯撹拌法では分散強化材を均一に混入分散させること、すなわち良好な複合化を得ることは困難であり、品質的に劣った複合材となる。また半凝固撹拌法では、良好な複合化は得られるが、この方法においては分散媒とする合金を良好な液固混相状態に維持しておくことが重要であるために、固相線－液相線間の温度幅が狭い合金では複合材の製造が困難になるなど、それぞれに問題を有している。
【０００７】
【発明が解決しようとする課題】この発明は上記の事情に鑑み、たとえ製造しようとする複合材の分散媒とする合金の固相線－液相線間の温度幅がないものであっても、品質の良好な複合材が安価でかつ容易に得られる製造方法を提案することを目的とする。
【０００８】
【課題を解決するための手段】この発明の要旨は、分散強化型金属基複合材の分散媒とする合金の目標成分組成を、その固相線－液相線間の温度幅に比しより広い温度幅となる成分組成と残りの成分組成とにわけ、上記温度幅がより広い成分組成に調整した液固混相スラリ中へ分散強化材を添加・混入して予複合材となし、上記残りの成分組成に調整した撹拌溶湯に対し該予複合材を混入して目標成分組成に調製することを特徴とする分散強化型金属基複合材の製造方法であり、
【０００９】上記において、撹拌溶湯が純金属ないしはこれを基とする極低合金であるものであり、さらに、分散強化材がセラミックス粒子、撹拌溶湯が純銅ないしは希薄銅合金であり、得られる複合材が高強度高導電材料であるものである。
【００１０】
【作用】この発明の作用をさらに詳しく以下に述べる。溶湯撹拌法では溶湯を造ることはいとも簡単であるが、その粘度が低いために分散強化材を均一に混入させること、いわゆる良好な複合化は得られない。一方、半凝固撹拌法では分散強化材の混入には好適であるが、分散媒とする合金の固相線－液相線間の温度幅が狭いと良好な液固混相状態を分散強化材の添加時も含めて安定して維持することが困難であり、良好な複合化は得られなくなる。
【００１１】したがって、この発明では、上記の特性を考慮して、液固混相状態の安定して維持できる成分組成の液固混相スラリ中へ分散強化材を混入してあらかじめ

分散強化材を均一に分散させた予複合材を造ること、その後、この予複合材を撹拌溶湯へ混入することによって結果的に複合材の分散媒とする合金の目標成分組成に調製された複合材を製造するようにしたものである。

【００１２】上記についてさらに具体的に以下に述べる。製造しようとする複合材の分散媒とする合金の目標成分組成を２つの成分組成Ａ及びＢにわける。すなわち、Ａは目標成分組成より固相線－液相線間の温度幅がより広い成分組成を選択し、Ｂは残りの成分組成として、ＡとＢとを合金化することによって目標成分組成になるようにする。

【００１３】ここで成分組成Ａの固相線－液相線間の温度幅は30℃以上とすることが好ましい。

【００１４】そして、成分組成Ａに調整した液固混相スラリに分散強化材を混入してあらかじめ複合化した予複合材を造り、成分組成Ｂに調整した撹拌溶湯に対して上記予複合材を混入させＡとＢとが合金化することによって分散媒とする合金が目標成分組成に調製された複合材となる。

【００１５】なお、上記予複合材の撹拌溶湯への混入に際しては、スラリ状で装入してもよく、一度塊状にしたのちこれを装入することもよい。ただし、塊状にしたのち装入する場合にはその媒体が容易に溶解するように小片に切断したものを用いることが好ましい。

【００１６】このように、分散強化材を添加・混入する液固混相スラリの成分組成を、複合材の分散媒とする合金の目標成分組成より固相線－液相線間の温度幅がより広い成分組成Ａとするので、安定して良好な液固混相状態を容易に造りだすことができ、この良好な液固混相状態のスラリ中へ分散強化材を添加・混入するので複合状態の良好な予複合材が得られる。

【００１７】ついで、この予複合材を成分組成Ｂの撹拌溶湯へ装入するので、予複合材の媒体は溶解してＡとＢとが容易に合金化し、得られる複合材の分散媒とする合金の目標成分組成に調製されたものとなり、分散強化材も分散媒中に均一に分散した複合材が得られる。

【００１８】なお、上記において、撹拌溶湯に予複合材を装入して完全に溶解させるまでは、予複合材中に分散している分散強化材の均一分散及びＡとＢとの完全な合金化をはかるため溶湯の撹拌を続けることが肝要である。

【００１９】また、高導電性が要求される銅合金のように分散媒の目標成分組成が低合金の場合、成分組成Ａを液固混相スラリを造り易い成分組成にするため、成分組成Ｂは純金属ないしはこれに近い極低合金となる。ただし、分散媒が高合金や共晶合金組成あるいはこれに近い成分組成のものにあってはこの限りではない。

【００２０】さらに、この発明は、Ａｌ系合金、Ｃｕ系合金及び他の合金系に有利に適用できるが、特に高導電性を維持して、強度向上がはかれることから、分散強化材にセラミックス、撹拌溶湯に純銅ないしは希薄銅合金を用いた高強度導電材料の製造に用いて好適である。

【００２１】

【実施例】まず、この発明の実施例に用いた複合材製造装置を図面にもとづいて説明する。図１は複合材製造装置の説明図である。この図において、１はるつぼ、２は撹拌用回転子、３は分散強化材添加装置、４は追加成分装入装置、５は鋳型であり、これらは真空タンク６で形成する密閉構造の空間内に設置され、真空タンク６には排気口７及び雰囲気ガス導入口８が設けられている。

【００２２】この発明の適合例として、上記複合材製造装置を用い、分散媒の目標成分組成がＣｕ －0.19mass％Ｓｎ 合金（固相線－液相線温度幅：６℃）で分散強化材（Al_2O_3）が１wt%分散した複合材の製造を下記により行った。

【００２３】分散媒の目標成分組成より固相線－液相線間の温度幅が広い成分組成として選択したＣｕ －１mass％Ｓｎ 合金（固相線－液相線温度幅：33℃）2500ｇをるつぼ１内で、温度：1067℃、固相率：0.3 の液固混相スラリとし、撹拌用回転子２で撹拌を加えながら分散強化材添加装置３から粒径：１μｍ のAl_2O_3粒子を、上記液固混相スラリ中へ 1.0ｇ／min の添加速度で 132分間にわたって合計 132ｇ添加し、その後撹拌用回転子２による撹拌を続けながら 1125 ℃に昇温したのち、鋳型５へ移注し予複合材鋳塊（Ｃｕ －１mass％Ｓｎ 合金：95wt％、Al_2O_3粒子：５wt%）を鋳造し、この鋳塊を20×20×20mmの寸法に切断した。

【００２４】つぎに、純銅 3000 ｇをるつぼ２内で温度：1133℃（液相線温度＋50℃）へ昇温した溶湯を撹拌用回転子２で撹拌を加えながら30分間保持したのち、この撹拌溶湯へ上記の切断した予複合材 750ｇを追加成分装入装置４から装入してその媒体を溶解し、純銅と合金化させると共に分散強化材の均一分散化をはかり、分散媒とする合金の目標成分組成に調製したのち、鋳型５へ移注して複合材鋳塊（Ｃｕ －0.19 mass ％Ｓｎ 合金：99 wt%、Al_2O_3粒子：１wt%）とした。

【００２５】かくして得られた複合材鋳塊について、分散強化材の分散状況、導電率、硬さなどを調査した。この結果分散強化材は均一に分散していて、導電率：75％、硬さ：70（HR_F）の高強度高導電率の材料が得られた。

【００２６】一方比較例として、分散媒の目標成分であるＣｕ －0.19mass％Ｓｎ 合金2400ｇをるつぼ１内で液固混相スラリを造るべく試みたが、撹拌浴にて液相線温度近く（1082℃）に下げるとシェルの発生が著しくなり、これ以上温度を下げることは不可能であった。そこで、撹拌浴の状態が安定な 1132 ℃の温度に保持して粒径：１μｍ のAl_2O_3粒子の添加を試みたが、Al_2O_3粒子はほとんど浴面上に浮いたままで浴中へ混入されなかった。

【００２７】

【発明の効果】この発明は、複合材の分散媒とする合金の目標成分組成を、その固相線－液相線間の温度幅に比しより広い温度幅となる成分組成と残りの成分組成とにわけ、前者の成分組成に調整した液固混相スラリに分散強化材を添加・混入して予複合材とし、後者の成分組成に調整した撹拌溶湯に対して上記予複合材を混入して目標成分組成に調整する複合材の製造方法であって、この発明によれば、従来の半凝固法にくらべ適用できる分散媒とする合金の種類が飛躍的に拡大し、かつ品質の良好な複合材を安価に製造することができる。

【図面の簡単な説明】

【図１】実施例に用いた複合材製造装置の説明図である。

【符号の説明】

1　るつぼ
2　撹拌用回転子
3　分散強化材添加装置
4　追加成分装入装置
5　鋳型
6　真空タンク
7　排気口
8　不活性ガス導入口

【図１】